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FAA-00-7952-5

(3)

10 November 1995

Federal Aviation Administration,
Office of the Chief Counsel,
Attention: Rules Docket (AGC-200),
Docket No. 28293,
800 Independence Avenue SW,
Washington DC 20591

Docket No. 28293,

Dear Chief Counsel:

I am writing about the proposed rule - Operational and Structural Difficulty Reports- which allows the FAA to identify trends that may affect aviation safety.

I have been using five years (1990-1994) of Service Difficulty Reports (SDR) to develop an Aviation Longitudinal File for individual aircraft (Annex 1). This record linkage will help identify factors affecting safety in specific aircraft models or airlines. My comments are based on this familiarity with the SDR files.

General comments:

1) SDR's are extremely useful. In spite of the current limitations in SDR data, it is possible to collate the records for individual aircraft. Improved reporting of registration and serial numbers, FAA's emphasis on additional and more timely data will make the Service Difficulty Report System a vital part of the safety data network.

2) Airlines vary widely in the promptness of reporting. Some major airlines report within a week of the event, others frequently report more than 6 weeks later (Annex 2).

3) Additional data on aircraft total time and cycles are essential for analyzing the problems of geriatric aircraft.

Specific comments:

1) Shall vs. must.

Proposed section 125.409 (a) states that each certificate holder **must** report.

Proposed sections 121.703 (a) and 121.704 (a) state that each certificate holder **shall** report.

Proposed section 121.704 (b) states that each certificate holder **shall** report any other failure or defect in aircraft structure that occurs or is detected at any time if ... that failure or defect has endangered or may endanger the safe operation of any aircraft it uses.

[] These and related sections should use "must".

2) Witholding of incomplete reports.

Current section 121.703 (g) states that "No person may withhold a report required by this section even though all information required in this section is not available".

[] This section, or an equivalent section, should be in the revised regulations.

3) Causes and results of the failure, malfunction or defect

Current sections 121.703 (e) 7-9 state that it is desirable to report additional information:

"7) Apparent cause of the failure, malfunction or defect (e.g. wear, crack, design deficiency, or personnel error).

(8) Whether the part was repaired, replaced sent to the manufacturer, or other action taken.

(9) Whether the aircraft was grounded.

(10) Other pertinent information necessary for more complete identification, determination of seriousness, or corrective action."

[] These sections, or equivalent, should be in the revised regulations.

[] The new proposed report form does provide place for "corrective action"; it should also include "cause".

4) Exemption of difficulties on thE Minimum Equipment List

Sections 121.703 (a) 9 and 11 allow the non-reporting of failures, malfunctions or defects that are deferrable according to the Minimum Equipment List. The reporting of difficulties that are on the Minimum Equipment List is a trivial burden; during the two years 1994 and 1995, there were fewer than 231 reports mentioning MEL and having no effect.

If MEL difficulties are reported, the adequacy of the Minimum Equipment List can be objectively assessed

[] Failures, malfunctions or defects, deferrable according to the Minimum Equipment List, should be reported.

5) Operational difficulties without emergency procedures

The proposed regulation 121.703 (a) 4 restricts reports of smoke, vapor, toxic or noxious fumes to situations requiring the use of emergency procedures.

Proposed regulation 121.703 (a) 2 restricts reports of false fire and smoke warnings to situations requiring the use of emergency procedures.

[] Both problems should be reported even when emergency procedures are not used.

6) Environmental effect of fuel dumping during flight

The dumping of thousands of pounds of fuel during flight has received little attention from environmental safety groups. Annex 3 details 11 examples of dumping over 30,000 pounds of fuel in the atmosphere.

[] The regulations should specify that the dumping of fuel be reported.

7. Proposed report form

The new Operational Difficulty Report given less prominence and less area to the registration number, essential for linking individual reports, than on the Service Difficulty Report.

[] The position for Registration number should be more prominent with more space.

Although the new Operational Difficulty report has more space for text than the Service Difficulty report, the space for "Discrepancy/Corrective action" could be further increased.

[] Make better use of the space now at the bottom of the form and moving the space for the captions "PROBLEM DESCRIPTION" and "SUBMITTED BY" to the left margin.

Again, the additional and more timely data will make the Service Difficulty Report System a vital part of the safety data network.

Sincerely,

Alex Richman MD MPH
President
AlgoPlus Consulting Limited

Presented at the Computer Theater
American Public Health Association
Annual Meeting
San Diego November 1, 1995

Aviation Longitudinal File
ALF 1.0

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A computerized system for using Service Difficulty Reports to produce a longitudinal record for an individual aircraft.

This handout shows some preliminary results for unscheduled or emergency landings.

- PURPOSE:
  To develop indicators that measure degrees of aviation safety

- REQUIREMENTS:
  1) Sufficient number of events for statistical significance
  2) Data are derived from current data bases
  3) Indicators are predictive of future incidents

- METHOD:
  Convert Service Difficulty Reports into longitudinal record for individual aircraft

Unscheduled or emergency landings
RESULTS

1. ... are relatively frequent

2. ... are not random events, they cluster

3. ... are predictive for the next year

4. ... are "dose" related

Truncated file, aircraft with 60+ seats
DRAFT 9 November 1995

Unscheduled or emergency landings

1. ... are relatively frequent

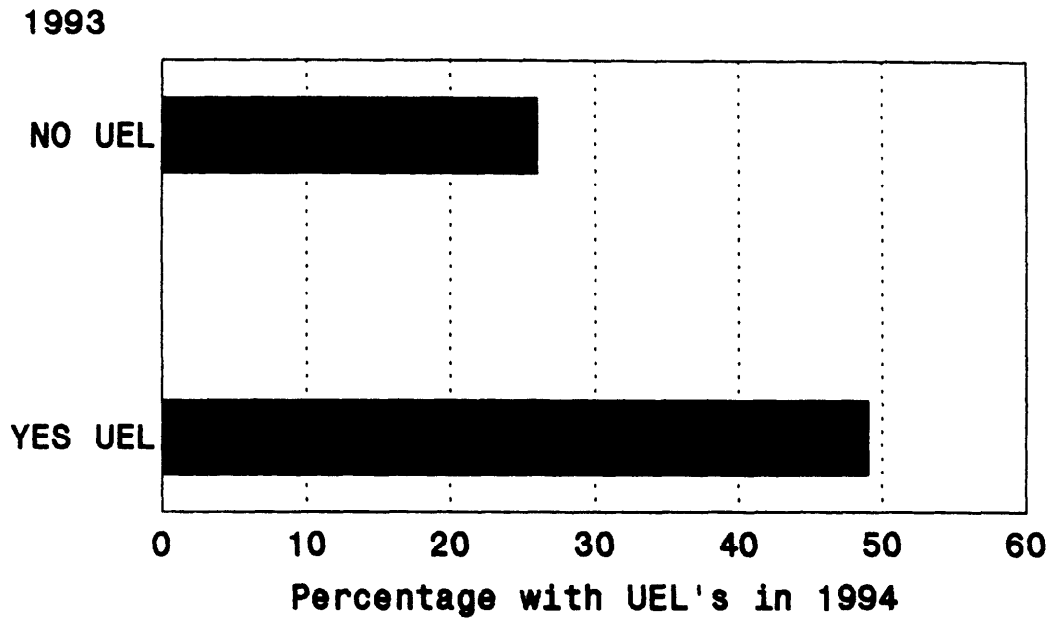
- Five years, 1990-1994
  1,845 aircraft
  5,644 UEL's

- One year, 1994
  947 aircraft
  1,401 UEL's

Truncated file, aircraft with 60+ seats
DRAFT 9 November 1995

Unscheduled or emergency landings

2 ... are predictive for the next year



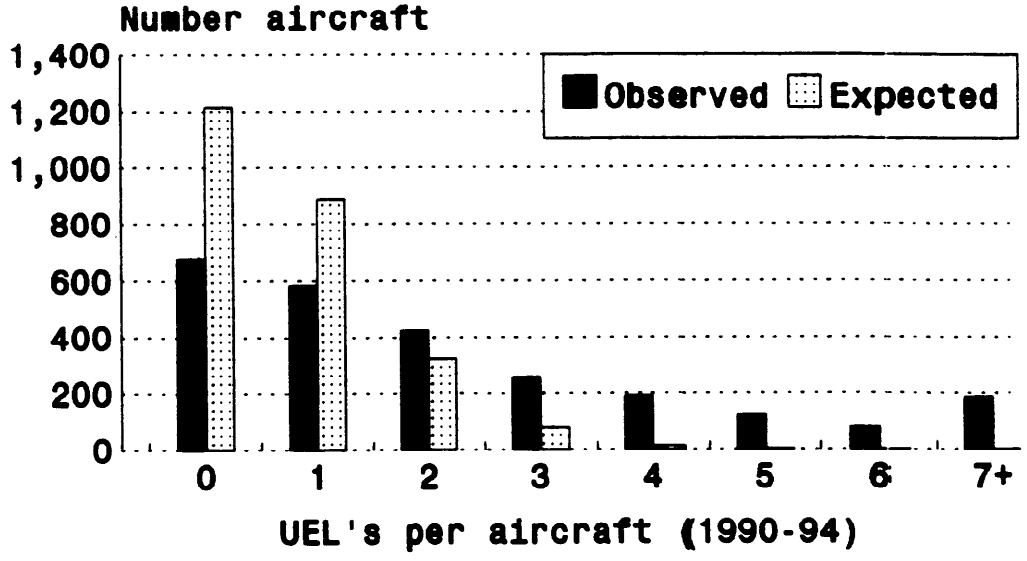
Truncated file, aircraft with 60+ seats
DRAFT 9 November 1995

5BI_8

Unscheduled or emergency landings

3 ... are not random events, they cluster

Unscheduled or emergency landings Number of UEL's per aircraft Observed vs expected (Poisson)

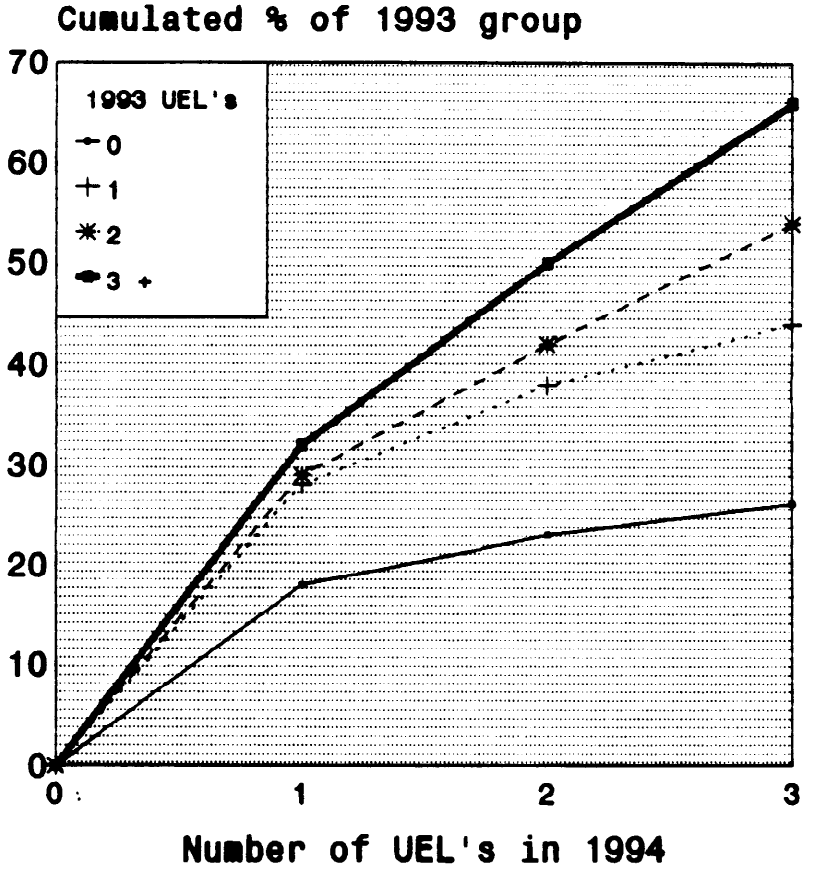


ALF 1.0 Truncated file of 2,443 aircraft with 60+ seats DRAFT
Aircraft with zero UELs had other SDR in 1994 chii sq=9,881 9 Nov 1995
 5BH_3

Unscheduled or emergency landings

4... are "dose" related

the more UEL's in one year,
the more the next year



Truncated file (N=2,443) excludes 219 records
Aviation Longitudinal File 1.0 DRAFT 9 Nov 95
 5BH_2

Conclusions

1. Record linkage of SDR's for individual aircraft is feasible

2. UEL's are a valid indicator of part of the spectrum of aviation safety

3. <u>Next steps</u>:

   A... Increase number of matched records for individual aircraft

   B... Add data on age, time and cycles

   C... Standardize rates of UEL's for specific aircraft models and airlines

   D... Consider adding other indicators of the spectrum of aviation safety

SDRs DELAYED 6 WEEKS OR MORE

Date Issued	Date Difficulty	Effect	Seats	Op Code
2/24/95	1/1/95	Unscheduled Landing,	172	USAA
2/10/95	1/2/95	Unscheduled Landing,	330	AALA
2/17/95	1/3/95	Unscheduled Landing,	85	CALA
3/20/95	1/5/95	Unscheduled Landing,	345	SCNA
2/24/95	1/8/95	Unscheduled Landing,	124	USAA
3/3/95	1/13/95	Unscheduled Landing,	134	MRKA
3/20/95	1/14/95	Unscheduled Landing,	100	USAA
3/20/95	1/20/95	Unscheduled Landing,	134	SCNA
3/3/95	1/23/95	Unscheduled Landing,	116	ASTY
4/7/95	1/24/95	Unscheduled Landing,	178	CLCA
4/7/95	1/27/95	Unscheduled Landing,	85	VJ6A
3/24/95	1/27/95	Unscheduled Landing,	172	ASAA
3/20/95	1/28/95	Unscheduled Landing,	100	USAA
4/7/95	1/30/95	Unscheduled Landing,	172	CALA
3/20/95	2/1/95	Unscheduled Landing,	85	Y2PA
3/31/95	2/4/95	Unscheduled Landing,	134	CALA
3/20/95	2/4/95	Unscheduled Landing,	100	USAA
4/7/95	2/4/95	Unscheduled Landing,	85	VJ6A
3/20/95	2/5/95	Unscheduled Landing,	149	CALA
3/31/95	2/6/95	Unscheduled Landing,	100	USAA
3/20/95	2/6/95	Unscheduled Landing,	85	USAA
3/31/95	2/10/95	Unscheduled Landing,	172	CALA
3/31/95	2/14/95	Unscheduled Landing,	172	CALA
4/7/95	2/20/95	Unscheduled Landing,	345	CALA

SDR's DELAYED ONE WEEK OR LESS

Date Diffic	Date Issued	Effect	Seats	Op Code
1/3/95	1/6/95	Unscheduled Landing,	134	NWAA
1/6/95	1/13/95	Unscheduled Landing,	85	NWAA
1/6/95	1/13/95	Unscheduled Landing,	85	NWAA
1/6/95	1/13/95	Unscheduled Landing,	182	NWAA
1/7/95	1/13/95	Unscheduled Landing,	85	NWAA
1/8/95	1/13/95	Unscheduled Landing,	182	NWAA
1/8/95	1/13/95	Unscheduled Landing,	240	FDEA
1/8/95	1/13/95	Unscheduled Landing,	139	NWAA
1/9/95	1/13/95	Unscheduled Landing,	182	NWAA
1/9/95	1/13/95	Unscheduled Landing,	178	NWAA
1/10/95	1/13/95	Unscheduled Landing,	182	NWAA
1/28/95	2/3/95	Unscheduled Landing,	345	NWAA
1/28/95	2/3/95	Unscheduled Landing,	85	NWAA
2/3/95	2/10/95	Unscheduled Landing,	182	NWAA
2/5/95	2/10/95	Unscheduled Landing,	182	NWAA
2/11/95	2/17/95	Unscheduled Landing,	495	NWAA
2/18/95	2/24/95	Unscheduled Landing,	85	NWAA
2/19/95	2/24/95	Unscheduled Landing,	85	NWAA
2/19/95	2/24/95	Unscheduled Landing,	182	NWAA
2/26/95	3/3/95	Unscheduled Landing,	85	NWAA
3/2/95	3/3/95	Unscheduled Landing,	139	NWAA

3/3/95	3/10/95	Unscheduled Landing,	495	NWAA
3/4/95	3/10/95	Unscheduled Landing,	345	NWAA
3/4/95	3/10/95	Unscheduled Landing,	495	NWAA
3/4/95	3/10/95	Unscheduled Landing,	85	NWAA
3/5/95	3/10/95	Unscheduled Landing,	85	NWAA
3/6/95	3/10/95	Unscheduled Landing,	85	NWAA
3/6/95	3/10/95	Unscheduled Landing,	345	NWAA
3/6/95	3/10/95	Unscheduled Landing,	85	NWAA
3/14/95	3/20/95	Unscheduled Landing,	134	NWAA
3/17/95	3/24/95	Unscheduled Landing,	495	NWAA
3/20/95	3/24/95	Unscheduled Landing,	85	NWAA
3/25/95	3/31/95	Emergency Descent,	134	NWAA
3/29/95	3/31/95	Unscheduled Landing,	495	NWAA
3/31/95	4/7/95	Unscheduled Landing,	139	NWAA

Text Description:	DURING ROTATION, THE NR 3 ENGINE EXPERIENCED A COMPRESSOR STALL. ALL ENGINE INDICATIONS REMAINED NORMAL DURING CLIMB-OUT. 110,000 LBS OF FUEL WAS DUMPED AND THE AIRCRAFT RETURNED TO BOS WHERE AN UNEVENTFUL LANDING WAS ACCOMPLISHED. BIRDSTRIKE EVIDENCE WAS FOUND AND AN INSPECTION AND A BOROSCOPE INSPECTION WAS ACCOMPLISHED. CHECKED OK.
Problem:	Engine Power Loss
Effect:	Unscheduled Landing
Severity:	
When:	Takeoff
Submitter:	Air Carrier/Taxi [121, 123, 127, 135.2]
Make:	DOUGLAS
Model:	DC-10-40
FAA Code:	3023508
N-Number:	147US
Operator:	NORTHWEST AIRLINES I

Text Description:	DURING TAKEOFF, A SLIGHT NOISE WAS NOTED. PASSING 9800 FT IN CLIMB, NR 1 ENGINE N1 ROSE ABOVE RED LINE, EGT ROSE ABOVE 980 DEGREES, AND A BANGING NOISE WAS HEARD. THE ENGINE WAS SHUT DOWN WITH NO ATTEMPT TO RELIGHT. 90,000 LBS OF FUEL WAS DUMPED AND THE AIRCRAFT RETURNED TO BOS WHERE AN UNEVENTFUL TWO ENGINE LANDING WAS MADE. PIECES FROM BLOWN NR 6 TIRE WERE FOUND TO HAVE BEEN INGESTED IN THE ENGINE. AIRCRAFT WAS FERRIED TO MSP WHERE THE ENGINE WAS REPLACED.
Problem:	Foreign Object Impact
Effect:	Unscheduled Landing
Severity:	
When:	Climb
Submitter:	Air Carrier/Taxi [121, 123, 127, 135.2]
Make:	DOUGLAS
Model:	DC-10-40

Text Description:	DURING CLIMB, THE NO.2 ENGINE EXPERIENCED A FIRE WARNING INDICATION ON 'A' LOOP, 'B' LOOP DID NOT INDICATE OR TEST. THE ENGINE WAS SHUT DOWN, THE FIRE BOTTLE WAS DISCHARGED, 90,000 LBS OF FUEL WAS DUMPED, AND THE AIRCRAFT RETURNED TO HNL WHERE AN UNEVENTFUL TWO ENGINE LANDING WAS MADE. A LOOSE CLAMP WAS FOUND ON THE EIGHTH STAGE BLEED DUCT BETWEEN THE ENGINE AND THE LOW PRESSURE BLEED CHECK VALVE. THE CLAMP WAS REPLACED AND DAMAGED WIRING WAS REPAIRED. THE SYSTEM AND ENGINE CHECKED OK ON RUN-UP.
Problem:	Warning Indication
Effect:	Unscheduled Landing
Severity:	
When:	Climb
Submitter:	Air Carrier/Taxi [121, 123, 127, 135.2]
Make:	MCDONNELL-DOUGLAS

Text Description:	DURING INITIAL CLIMB, THE NR 1 ENGINE EXPERIENCED LOSS OF OIL QUANTITY AND PRESSURE AND WAS SHUT DOWN. 70,000 LBS OF FUEL WAS DUMPED AND THE AIRCRAFT RETURNED TO SFO WHERE AN UNEVENTFUL TWO ENGINE LANDING WAS ACCOMPLISHED. BLACK OIL WAS FOUND AND THE AIRCRAFT WAS FERRIED TO MSP FOR AN ENGINE CHANGE.
Problem:	Warning Indication
Effect:	Unscheduled Landing
Severity:	
When:	Climb
Submitter:	Air Carrier/Taxi [121, 123, 127, 135.2]
Make:	DOUGLAS
Model:	DC-10-40
FAA Code:	3023508
N-Number:	151US
Operator:	NORTHWEST AIRLINES I
Op Code:	NWAA

Text Description:	DURING CLIMB, THE NO.3 ENGINE MANIFOLD FAIL LIGHT ILLUMINATED AFTER TURNING ON THE WING ANTI-ICE. DUMPED 70,000 LBS OF FUEL AND RETURNED TO GUM. REPLACED THE RIGHT ANTI-ICE PRESSURE DIFFERENTIAL SWITCH.
Problem:	Warning Indication
Effect:	Unscheduled Landing
Severity:	
When:	Climb
Submitter:	Air Carrier/Taxi [121, 123, 127, 135.2]
Make:	MCDONNELL-DOUGLAS
Model:	DC-10-30
FAA Code:	3023501
N-Number:	226NW
Operator:	NORTHWEST AIRLINES I
Op Code:	NWAA
Date of Difficulty:	8/17/94
Comp Name:	AIRFOIL ANTI-ICE, DE

Text Description:	DURING CLIMB, NOTICED A 15,000 LB FUEL IMBALANCE AND RUDDER TRIM INPUT WAS NEEDED. DUMPED 60,000 LBS OF FUEL AND RETURNED TO BOS. VERIFIED FUEL QUANTITY AND MEL'ED NR 3 FUEL QUANTITY INDICATOR.
Problem:	Other
Effect:	Unscheduled Landing
Severity:	
When:	Climb
Submitter:	Air Carrier/Taxi [121, 123, 127, 135.2]
Make:	DOUGLAS
Model:	DC-10-40
FAA Code:	3023508
N-Number:	158US
Operator:	NORTHWEST AIRLINES I
Op Code:	NWAA
Date of Difficulty:	9/19/94
Comp Name:	FUEL QUANTITY SENSOR
PriMake:	DOUG

Text Description:	DURING TAKE-OFF, AUTO SLAT EXTENSION AND CAPTAIN'S STALL WARNING ACTIVATED. AIRCRAFT RETURNED TO BOS AND DUMPED 50000 LBS OF FUEL. REPLACED NO.1 STALL WARNING ANGLE OF ATTACK SENSOR AND THE AT/SC COMPUTER. OPERATIONAL CHECK OK.
Problem:	Warning Indication
Effect:	Unscheduled Landing
Severity:	
When:	Takeoff
Submitter:	Air Carrier/Taxi [121, 123, 127, 135.2]
Make:	DOUGLAS
Model:	DC-10-40
FAA Code:	3023508
N-Number:	141US
Operator:	NORTHWEST AIRLINES I
Op Code:	NWAA
Date of Difficulty:	7/4/94
Comp Name:	STALL WARNING SYSTEM

Text Description:	DURING TAKEOFF, THE NR 2 ENGINE COMPRESSOR STALLED AND SHUT DOWN. DUMPED 43,000 LBS OF FUEL AND RETURNED TO LAX. FERRIED AIRCRAFT TO MSP AND REPLACED THE NR 2 ENGINE.
Problem:	Engine Power Loss
Effect:	Unscheduled Landing
Severity:	
When:	Takeoff
Submitter:	Air Carrier/Taxi [121, 123, 127, 135.2]
Make:	DOUGLAS
Model:	DC-10-40
FAA Code:	3023508
N-Number:	153US
Operator:	NORTHWEST AIRLINES I
Op Code:	NWAA
Date of Difficulty:	3/6/95
Comp Name:	COMPRESSOR SECTION
PriMake:	PWA

Text Description:	DURING CLIMB, THE NR 3 MANIFOLD FAIL LIGHT ILLUMINATED AFTER TURNING ON THE WING ANTI-ICE. DUMPED 38,000 LBS OF FUEL AND DIVERTED TO BOS. LANDED WITHOUT INCIDENT. REPLACED RIGHT WING PRESSURE SWITCH. OPERATIONAL CHECK OK.
Problem:	False Warning
Effect:	Unscheduled Landing
Severity:	
When:	Climb
Submitter:	Air Carrier/Taxi [121, 123, 127, 135.2]
Make:	MCDONNELL-DOUGLAS
Model:	DC-10-30
FAA Code:	3023501
N-Number:	226NW
Operator:	NORTHWEST AIRLINES I
Op Code:	NWAA
Date of Difficulty:	1/24/94
Comp Name:	PNEUMATIC INDICATING

Text Description:	DURING CRUISE, WHILE UPDATING OUT OF PARIS, NR 1 AND NR 2 INS HAD A RED WARNING AND UNABLE TO CLEAR. DIVERTED TO LGW AND DUMPED 35,000 LBS OF FUEL. REPLACED NR 1 INS AND UPDATED NR 2 AND NR 3. OPERATIONAL CHECK OK.
Problem:	Warning Indication
Effect:	Unscheduled Landing
Severity:	
When:	Cruise
Submitter:	Air Carrier/Taxi [121, 123, 127, 135.2]
Make:	DOUGLAS
Model:	DC-10-40
FAA Code:	3023508
N-Number:	161US
Operator:	NORTHWEST AIRLINES I
Op Code:	NWAA
Date of Difficulty:	9/12/93
Comp Name:	INERTIAL GUIDANCE SY

Text Description:	DURING CLIMB, THE NR 3 ENGINE OIL QUANTITY BEGAN TO DECREASE, THE OIL STRAINER LIGHT ILLUMINATED, AND THE ENGINE WAS SHUT DOWN. 30,000 LBS OF FUEL WAS DUMPED AND THE AIRCRAFT RETURNED TO HNL WHERE AN UNEVENTFUL TWO ENGINE LANDING WAS MADE. METAL AND BLACK OIL WERE FOUND. THE ENGINE WAS REPLACED.
Problem:	Warning Indication
Effect:	Unscheduled Landing
Severity:	
When:	Climb
Submitter:	Air Carrier/Taxi [121, 123, 127, 135.2]
Make:	DOUGLAS
Model:	DC-10-40
FAA Code:	3023508
N-Number:	150US
Operator:	NORTHWEST AIRLINES I
Op Code:	NWAA

Text Description:	DURING CLIMB-OUT HNL AT FL150, THE NR 2 ENGINE OIL PRESSURE LIGHT BEGAN TO FLICKER AND THE OIL FILTER BYPASS LIGHT CAME ON. THE ENGINE WAS SHUT DOWN, 30,000 LBS OF FUEL WAS DUMPED, AND THE AIRCRAFT RETURNED TO HNL WHERE AN UNEVENTFUL THREE ENGINE LANDING WAS MADE. BLACK OIL AND SLUDGE WERE FOUND IN THE OIL FILTER. THE ENGINE WAS REPLACED. CORRECTION: NR 3 ENGINE OIL PRESSURE LIGHT SHOULD BE NR 2 ENGINE OIL PRESSURE LIGHT.
Problem:	Warning Indication
Effect:	Unscheduled Landing
Severity:	
When:	Climb
Submitter:	Air Carrier/Taxi [121, 123, 127, 135.2]
Make:	BOEING
Model:	747-151
FAA Code:	1384891